

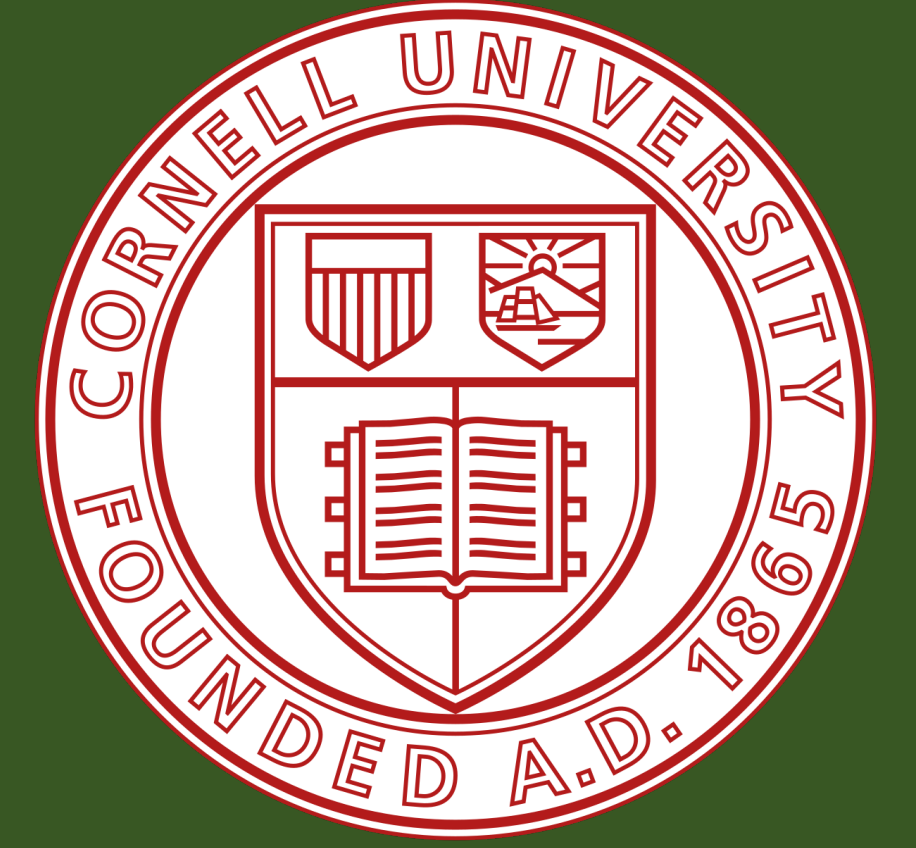


# Credible Evidence of Gender Discrimination Using Instrumental Inequality

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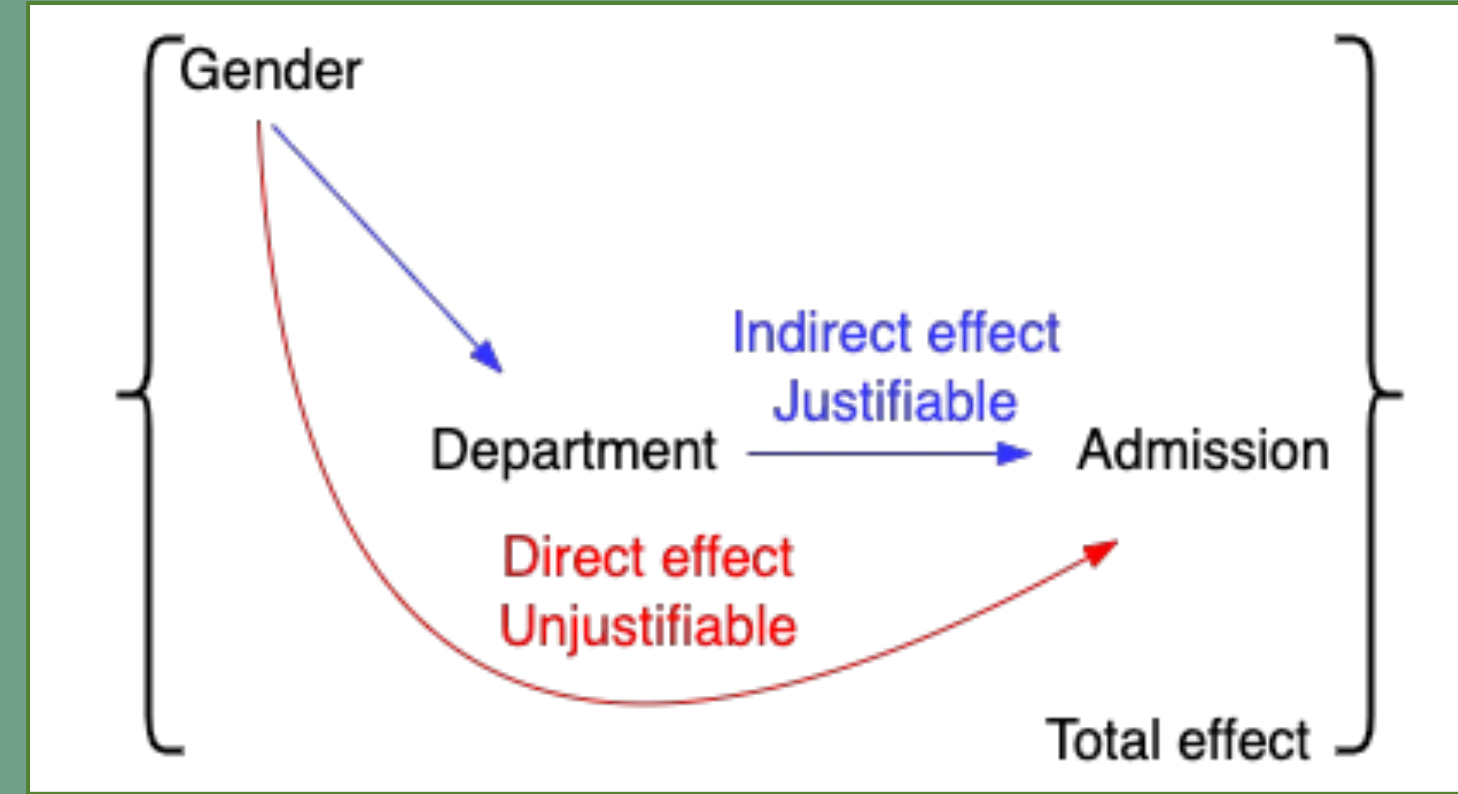


## INTRODUCTION

- A structural definition of gender discrimination
- Problems with existing methods
- New credible evidence for gender discrimination

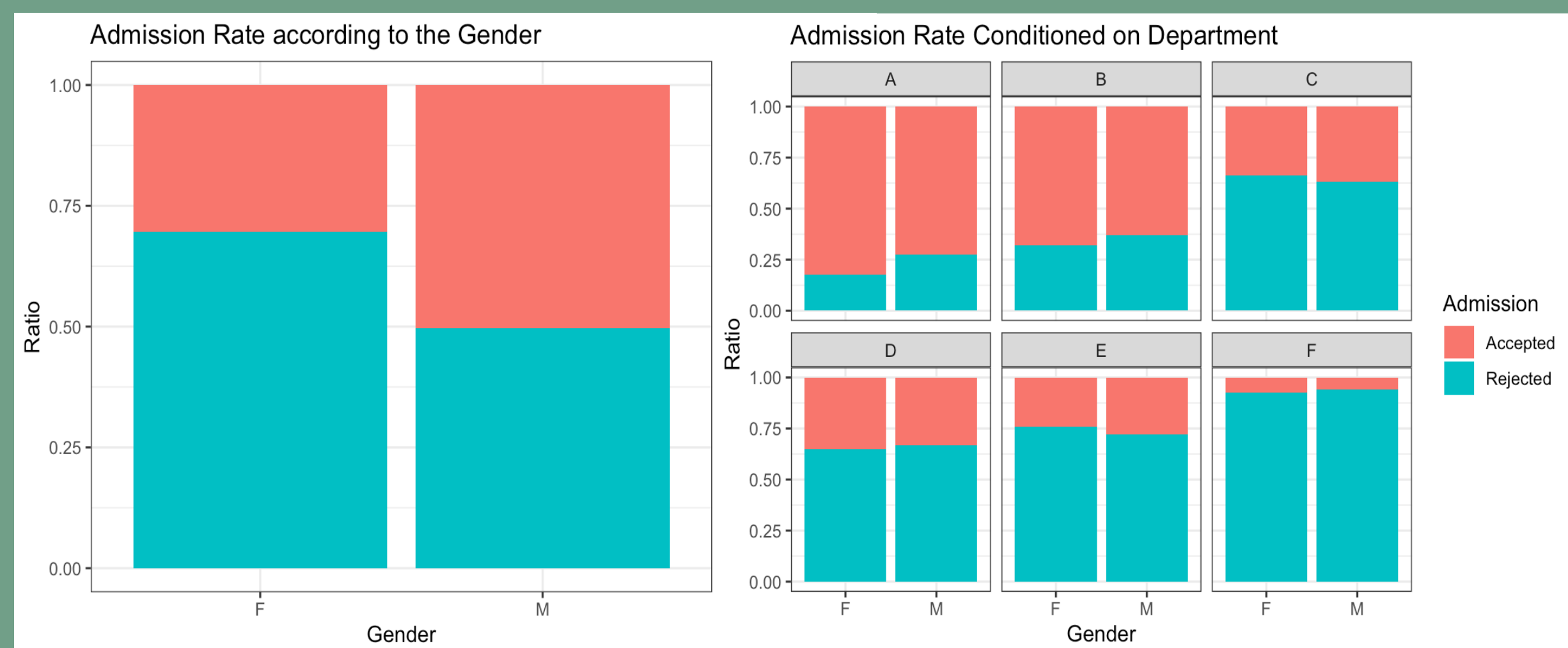
The causal meaning of gender discrimination

- (1) **Direct effect, not total effect:** When there is a disparity between genders, it cannot be deemed discrimination if a **reasonable factor** accounts for it (**indirect effect**).<sup>1</sup>
- (2) **Counterfactual and causal concept:** Discrimination should be determined in a **counterfactual way** ('but for' test).<sup>2</sup>



In the UC Berkeley example<sup>3</sup>

- The **total effect** of Gender on Admission:  $Pr(Accepted | Male) - Pr(Accepted | Female)$
- The **direct effect**:  $Pr(Accepted | Male, Department = A) - Pr(Accepted | Female, Department = A)$  shows no difference in the acceptance rates by gender within the same department.
- In this case, the **department** can be considered a **reasonable factor** for the difference in admissions between genders (indirect effect).



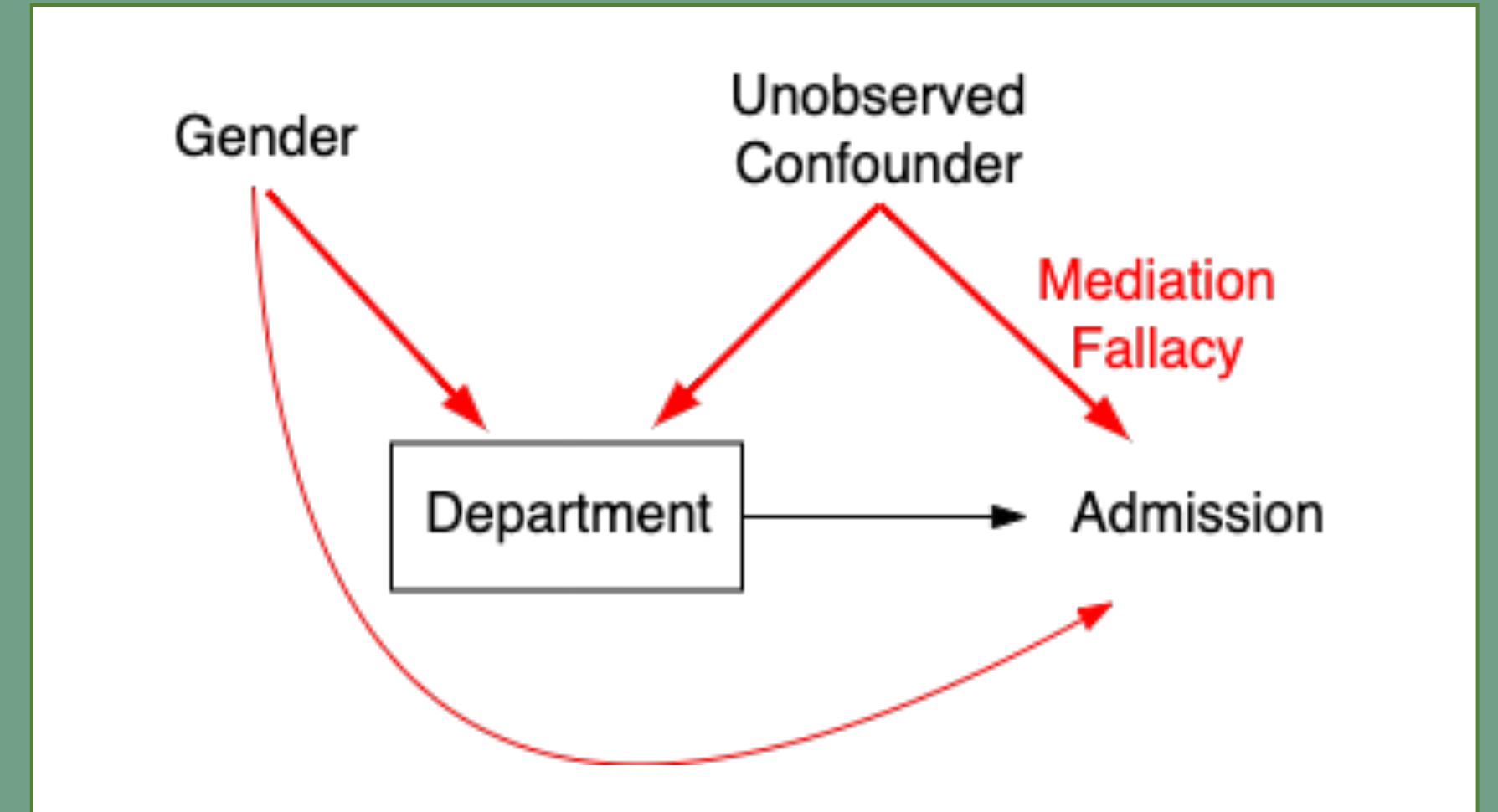
## METHOD

The concept of the gender discrimination

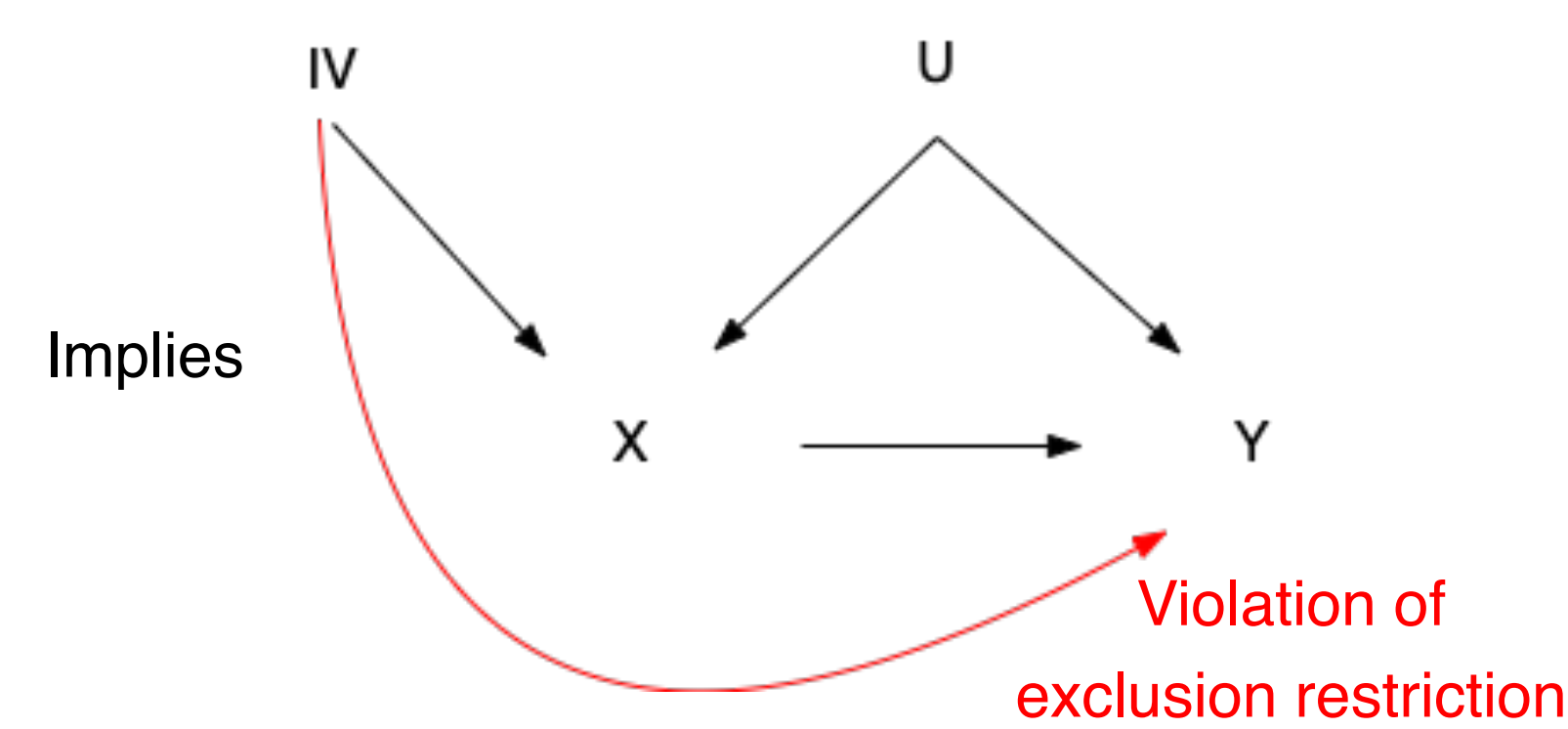
- Compare the impact of each gender on the outcome, **excluding justified mediation (direct effect)**.
- A comparison of outcomes between males and females is necessary to assess the impact of gender on these results (**counterfactual**).

**Limitation of existing methods: Mediation fallacy** (due to mediator-outcome confounding)

- When unmeasured mediator-outcome confounder exists, conditioning on the mediator (department) makes it hard to estimate the direct effect,<sup>4</sup> as it opens the path through a collider (department).



$$P(X = x, Y = y | IV = 0) + P(X = x, Y = 1 - y | IV = 1) > 1$$

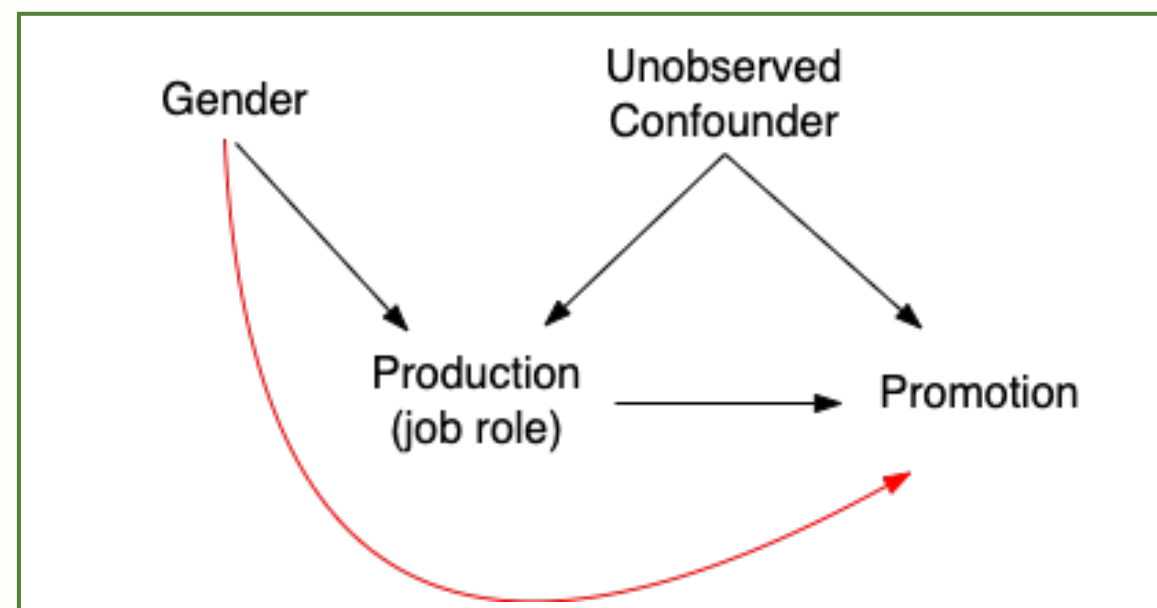


**New method: Gender as an instrumental variable**

- The gender one is born with is exogenous, which means that it can be considered an instrumental variable if it satisfies the exclusion restriction.
- '**Instrumental inequality**' empirically checks the exclusion restriction,<sup>5</sup> without relying on the assumption of no confounder between X and Y.<sup>6</sup>
- **Violation of the exclusion restriction** indicates a **direct effect of gender on the outcome** (gender discrimination).

## RESULTS

### Case 1: Gender Discrimination in Korea's Metal Industry (2019)



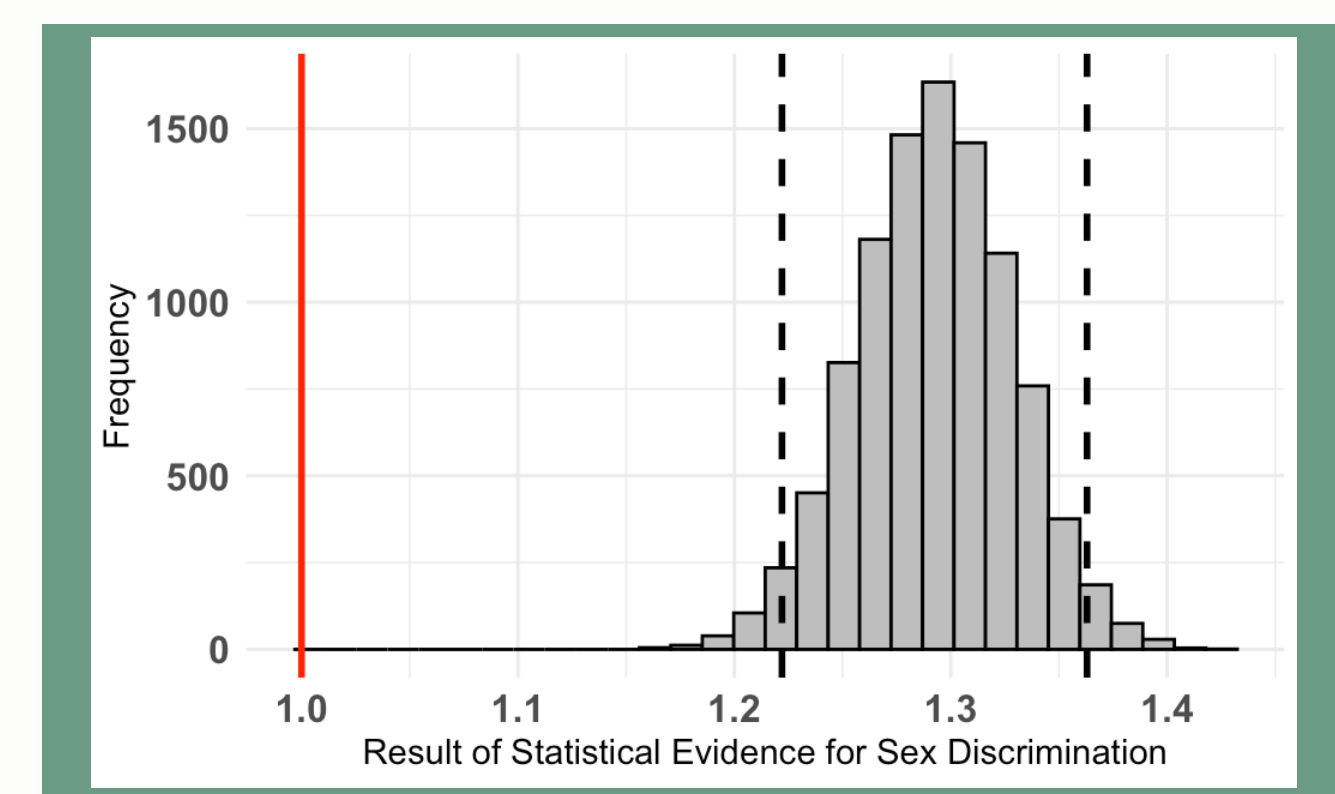
- A gender discrimination case decided by the Discrimination Remedies Committee of the National Human Rights Commission of Korea.<sup>7</sup>
- The CEO of the metal manufacturing company argued that **male production workers had an advantage in promotions due to factors such as greater physical strength compared to female production workers**.

Male (IV = 1)				Female (IV = 0)			
Promoted (Y=1)		Not Promoted (Y=0)		Promoted (Y=1)		Not Promoted (Y=0)	
Production (X=1)	Not (X=0)	Production (X=1)	Not (X=0)	Production (X=1)	Not (X=0)	Production (X=1)	Not (X=0)
182	205	20	7	19	7	151	0

Point estimate:

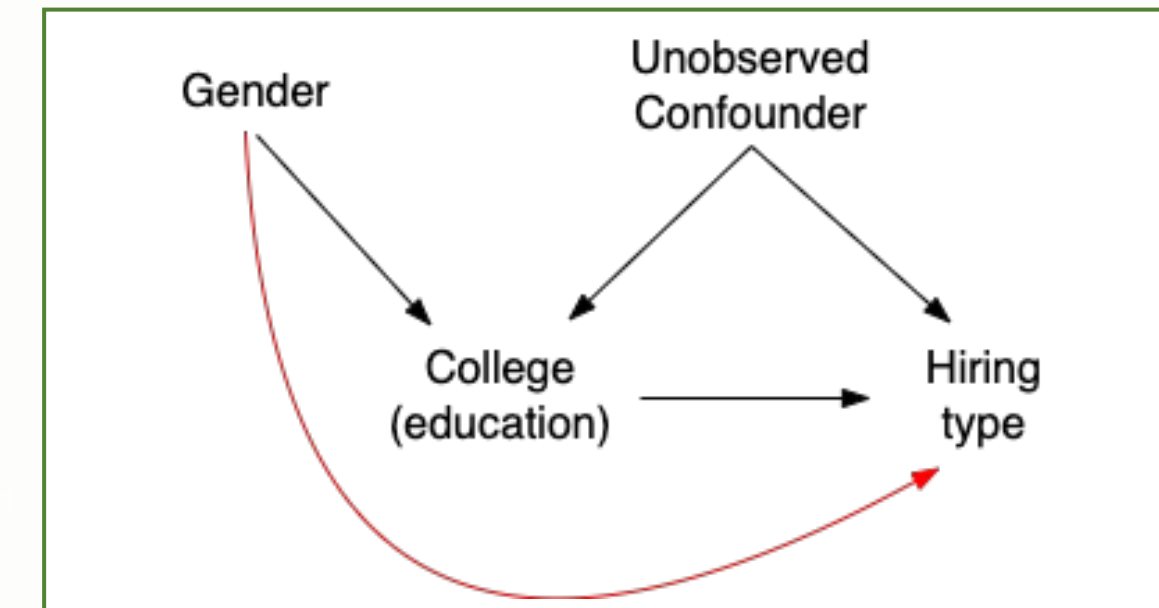
$$P(X = 1, Y = 0 | IV = 0) + P(X = 1, Y = 1 | IV = 1) = 1.293 > 1$$

Interval estimate:



Bootstrap result for 95% confidence interval (n = 10,000)

### Case 2: Gender Discrimination in Hiring Type of Female Workers with Lower Education (2020)



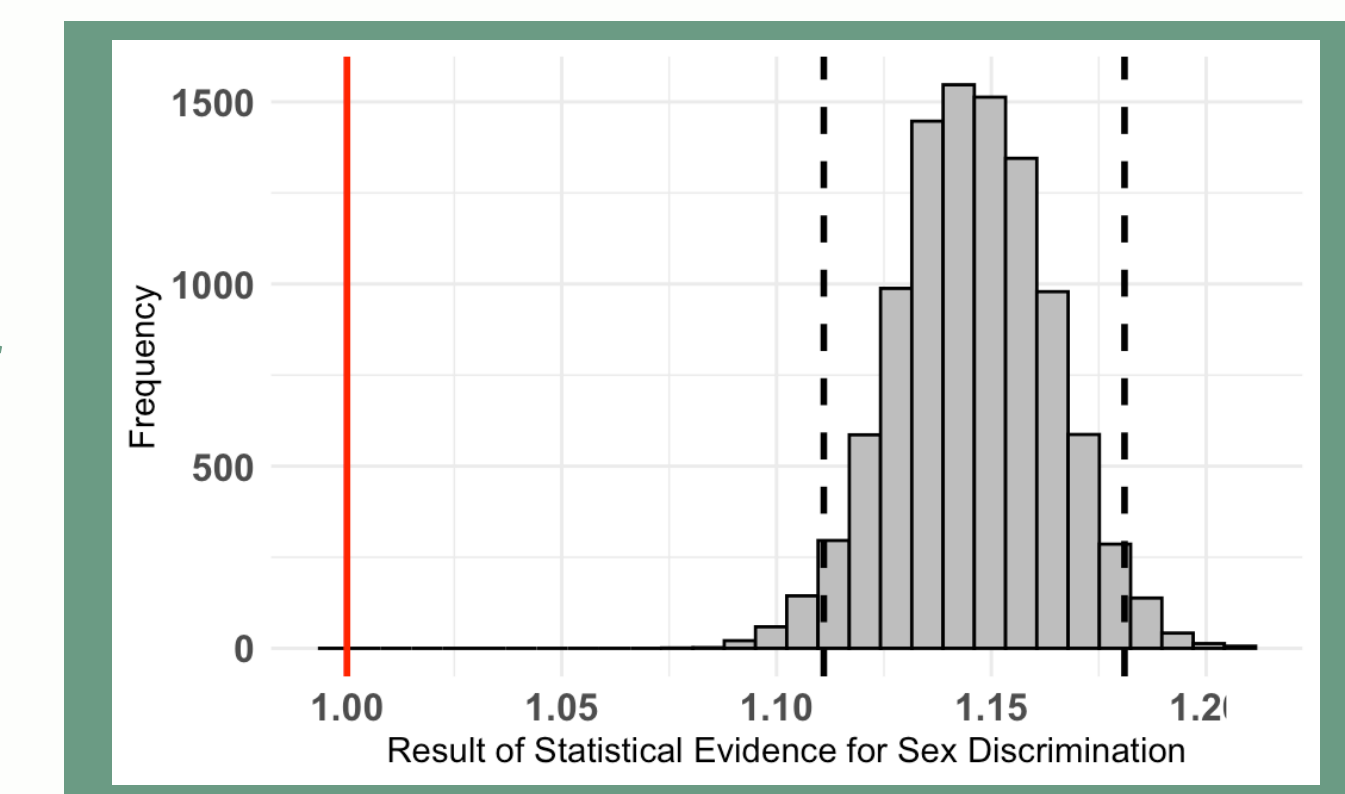
- The Financial Labor Union collected data to support their claim of gender discrimination in regular worker employment.<sup>8</sup>
- The banks argued that **the higher proportion of male regular workers in the financial sector was due to men having higher educational qualifications** (a college degree or higher).

Male (IV = 1)				Female (IV = 0)			
Regular (Y=1)		Non-regular (Y=0)		Regular (Y=1)		Non-regular (Y=0)	
College (X=1)	Not (X=0)	College (X=1)	Not (X=0)	College (X=1)	Not (X=0)	College (X=1)	Not (X=0)
880	5	195	59	527	55	527	303

Point estimate:

$$P(X = 1, Y = 0 | IV = 0) + P(X = 1, Y = 1 | IV = 1) = 1.146 > 1$$

Interval estimate:



Bootstrap result for 95% confidence interval (n = 10,000)

## CONCLUSIONS

- This study underscores the complexity of identifying and analyzing gender discrimination and challenges posed by conventional statistical methodologies.
- By employing instrumental inequality, the research provides a more accurate and nuanced analysis of gender discrimination.
- The findings advocate for a broader application of this methodological approach in gender discrimination research, highlighting its potential to uncover hidden biases.
- This research contributes significantly to the discourse on gender discrimination, offering a more credible and methodologically sound basis for identifying discrimination by not requiring more assumptions.<sup>6</sup>

## REFERENCES

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